

Chemical and physical speciation of copper in the subarctic North Pacific

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Organic complexation of Cu in seawater plays a major role in controlling the toxicity and bioavailability of Cu for marine microorganism. In this study, we determined the concentrations of Cu and its organic ligands in the soluble and dissolved phases in the subarctic North Pacific. Samples were taken from three stations in the subarctic North Pacific, CL-2 (western), CL-5 (central) and CL-16 (eastern), during summer 2017.

Concentrations of total dissolved and soluble Cu ranged from 1.28 nM –4.82 nM, and 0.47 nM –2.75 nM, respectively, in the subarctic North Pacific. At both CL-2 and CL-16, soluble Cu accounted for 30% - 100% of total dissolved Cu. The proportion of the soluble Cu fraction was low in surface waters, increased a maximum in the intermediate waters, and decreased slightly in deep waters. Two classes of organic ligands were detected in the surface and intermediate waters of CL-5 and CL-16, and in the intermediate waters of CL-2. In all other depths, only one class of ligand was detected. Concentrations of the stronger ligand (L_1) and weaker ligand (L_2) ranged from 1.02 nM –2.95 nM, and 0.77 nM –8.78 nM, respectively. The distributions of L_1 followed closely that of total dissolved Cu in the surface waters, and no clear trend was observed in the intermediate waters. At CL-2, L_1 mainly existed in the soluble phase, whereas for CL-16, soluble L_1 accounted for 50% - 100% of total dissolved L_1 . Concentrations of L_2 were relatively constant throughout the water column but elevated concentrations were detected in the surface waters of CL-5 and in the surface and intermediate waters of CL-16. On the other hand, there were a slight depletion of L_2 in the intermediate waters of CL-2.

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